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Abstract

Intriguingly, across the world the main social groups which practice polygyny do not consume alcohol. We investigate whether there is a correlation between alcohol consumption and polygynous/monogamous arrangements, both over time and across cultures. Historically, we find a correlation between the shift from polygyny to monogamy and the growth of alcohol consumption. Cross-culturally we also find that monogamous societies consume more alcohol than polygynous societies in the pre-industrial world. We provide a series of possible explanations to explain the positive correlation between monogamy and alcohol consumption over time and across societies.

Keywords: polygyny – monogamy – alcohol – cross cultural research – economics

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Jean-Leon Gerome - The Terrace of the Seraglio (1898)

1. Introduction

To a modern audience, the monogamous nature of human relationships seems obvious and normal. However, from a global, cross cultural perspective there is nothing 'normal' or 'obvious' about this. Instead, as Scheidel (2009) explains, until quite recently polygynous arrangements of marriage or cohabitation were the norm in world history.

Interestingly, while these days most societies are monogamous, polygyny[1] has not completely disappeared. Looking around the world, a few societies and cultures

[1] Since the term "polygamy" is often use instead of "polygyny", an important distinction should be pointed out: polygamy (from Greek : πολύ - *many*, and γάμος – marriage) refers to the case of an individual (male or female) having several partners at the same time; polygyny (from Greek : πολύ - *many*, and γυνή – *woman*) occurs when a

still allow and/or practice polygyny. There are some societies, such as some African indigenous tribes, where men have multiple wives. However the most well known cases that still practice polygyny are parts of the Muslim world and parts of the Church of Jesus Christ of Latter-Day Saints (Mormons) – more specifically the so called Mormon Fundamentalists.

What is intriguing is that these two groups are characterized by another distinguishing characteristic: they do not consume alcohol. While these groups are not the only social groups in the 21st centuries which do not consume alcohol, alcohol is widely consumed around the world these days – and in virtually all monogamous societies. Hence, it is intriguing that the two main social/religious groups which still practice polygyny also do not consume alcohol.

This raises two sets of questions: is this ad hoc observation representative of a true phenomenon? Does a real (positive) correlation between monogamy and alcohol consumption exist ? We address these questions in the first part of this paper. We analyze first how alcohol consumption and monogamy have evolved over time. Next, we use historical data on *pre-industrial societies* – among which there are a substantial number of cases of polygyny – and alcohol use in these societies and analyze whether there is a correlation. Interestingly, we do find evidence of a positive correlation between alcohol use and monogamy both over time and across cultures.

This then raises a second set of questions: why does such correlation seem to exist ? Is there a causal relationship between both? Does increased alcohol use leads to monogamy, or vice versa ? Or are there some other, more fundamental, factors at work which cause an observed correlation between alcohol use and monogamy across

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man has multiple women at the same time; polyandry (from Greek : πολύ - *many*, and άνδρας – man) when a woman has multiple men at the same time. However, since polyandry is very rare, many authors often use polygamy when referring to polygyny.

time and cultures ? In the second part of this paper we offer a series of potential explanations for such correlation. We conclude that there is no direct causality in either way, but that other factors cause specific changes in both alcohol use and marriage arrangements.

2. Related Literature

While – as far as we know – this paper is the first to address this issue, our analysis is related to a series of other studies in the literature. Analyses of the sexual behavior of men and their use of alcohol figured prominently in theories of, for example, Darwin and Freud. More recent related studies can be categorized in several groups.

A first set of studies look at cross-cultural differences in alcohol consumption habits. Most studies focus on pre-industrial cultures and try to link the different consumption habits to other characteristics of those cultures. For example, Horton (1945), Field (1962), Bacon et al. (1965) and McClelland et al. (1966) relate alcohol consumption to different types of economic activities (such as hunting versus agricultural production), insecurity of incomes and subsistence, and the hierarchical organization of the societies.

A series of more recent studies analyze the impact of alcohol use on sexual activities, mostly in Western societies. Many studies find a positive relationship between alcohol use on the one hand and a more promiscuous and high-risk sexual behavior on the other hand (e.g. Robertson and Plant, 1988; Bagnall et al., 1990 ; Hingson et al., 1990; Trocki et Leigh, 1991; Shrier et al. 1997; Staton et al. 1999; DeSimone 2010).

A third group of studies analyzes the polygynous/monogamous character of societies. They relate polygyny to various forms of resource inequality, climatic conditions, and social structures (Emlen and Oring, 1977; Hames, 1996; Kanazawa and Still 1999; Barber 2008; Scheidel, 2009).

While all of these studies are related to our paper, none of these studies analyzes the relationship between monogamy and alcohol use in a historic or cross-cultural framework.

3. Historical Analysis

3.1 The Historical Evolution of Monogamy and Polygyny

Higamous, hogamous, woman's monogamous,
Hoggamus, higgamus, men are polygamous.

William James (1990)
Oxford Book of Marriage

Polygyny, the mating system in which a male has multiple females at the same time, is the most common system among mammals. In nature, only 3% of about 4.000 mammalian species are monogamous. This social structure has been explained by referring to some basic elements of animal and human nature. According to Darwin's evolutionary theory, individuals have evolved to maximize their genetic representation in descendant generations (Betzig, 1995). While this reproductive instinct requires time and effort from both partners, females do typically contribute much more time and effort. With mammals, the gestation period is very long compared to other species as females are occupied first with the pregnancy and then with raising the offspring. In contrast, the contribution of males is often limited to the mating effort itself. Afterwards they immediately look for other females (Trivers 1972; Clutton-Brock & Vincent 1991). Fuentes (1999) examining the direct ancestors

of humans, i.e. different species of primates, finds that only 7 out of 200 species of primates (again 3%) can be defined as monogamous.

This social system continued in early human societies which were characterized by polygynous marriage arrangements (Low 2003, 2007). Darwin (1871, Chapter XX, pag. 363) wrote *"judging from the social habits of man as he now exists, and from most savages being polygamists, the most probable view is that primeval man originally lived in small communities, each with as many wives as he could support and obtain, whom he would have jealously guarded against all other men."*

There is indeed ample evidence that historically, in the majority of human societies, from the East to the West, polygyny was the norm, and sometimes in extreme forms. In China, Japan, Korea and in the rest of East Asia, polygynous practices have been present for thousands of years: emperors, leaders, rich men and important officials had several wives and many concubines. Also in Hindu society, polygyny was allowed. According to the *Bhagavata Purana*, Lord Krishna (one of the most important and worshipped deity in Hindu tradition) had 16,108 wives. In the ancient Near East (Pharaonic Egypt, Mesopotamia, Iran) as well as in various African kingdoms men used to have multiple women. The Old-Testament also mentions polygyny as a common and recognized practice: King Solomon had 700 wives and 300 concubines. Finally, also in the Pre-Columbian Americas and in Polynesian societies, polygyny was practiced.

These social arrangements have changed dramatically in more recent history. Nowadays polygynous arrangements are an exception while monogamy has become the norm. When did the shift occur ?

A first change can be traced back to the Greeks and Romans who introduced *formal* monogamy (Herlihy, 1995; Scheidel, 2009). Multiple wives were no longer permitted. (We will discuss the reasons for this later)

However, this did not imply an actual exclusive reproductive commitment. Men could still have multiple extra-marital relationships. This situation is well captured by the following quote of Demosthenes, a Greek philosopher: *"We have prostitutes for our pleasure, concubines for our health, and wives to bear us lawful offspring"*[2]. Moreover, the rest of the ancient world was still practicing formal polygyny. The Greeks and the Romans considered this *barbarian*[3] and with the expansion of the Roman Empire, formal monogamy started to be introduced in a large part of Europe. After the decline of the Roman Empire, Christian religion – which had integrated monogamy in its rules – survived and spread formal monogamy during the Middle Ages and the Modern Period. However, as under the Roman and Greek empires, despite the rigorous ethos of sexual egalitarianism that the Church was promoting, men who could afford it still had multiple sexual relationships with concubines (Brundage, 1987; Geary, 1988). As Goody (1983, p.191) writes, *"In Christian Europe ... concubinage was illegal and its offspring were illegitimate. Yet despite the constant admonitions against it, the practice flourished among laity and clerics alike".* Given-Wilson and Curteis (1984) find that 10 of the 18 English kings from 1066 to 1485 had at least 41 illegitimate children that can be identified *"with a fair degree of certainty"*.

Researchers point at the Industrial Revolution as the main turning point in this situation. Around that time came the end of concubinage and polygynous

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[2] Demosthenes, 59: Apollodorus' speech Against Neaira

[3] As written by Euripides: "*We count it as shame that over two wives one man hold wedlock's reins"*

arrangements and the definitive transition from *formal* to *social* monogamy – with social monogamy meaning an exclusive reproductive commitment (Betzig, 1986; Galor et al., 2004; Gould et. al., 2004).

This transition has been so dramatic that nowadays there is a strong predominance of monogamy. The main exceptions are part of the Muslim world, the Mormon Fundamentalists, and some indigenous, mainly African, tribes. The *Sharia* (Islamic Law) allows men to take more than one woman and up to a maximum of four. The passage of the Quran dealing directly with the practice of polygyny is in Quran 4.3:

> *"And if you fear that you cannot act equitably towards orphans, then marry such women as seem good to you, two and three and four; but if you fear that you will not do justice (between them), then (marry) only one or what your right hands possess; this is more proper, that you may not deviate from the right course".*

However, there are differences in the different Muslim countries. In some countries, such as Saudi Arabia and Kuwait, the *Sharia* represents the main source of law and polygyny is widely practiced. In other Muslim countries, even if the Sharia is not the main source of law, it still plays an important role. For instance, in Gambia and Malaysia the civil law allows men to have multiple wives. Finally, we have countries in which only part of the population may have polygynous marriages, based either on the geographic area or on the religion. In Nigeria and Eritrea, polygyny is not recognized by the central government but it can be practiced in some regions that follow the Sharia. In India and Sri Lanka polygynous arrangements are prohibited for everyone except for the Muslim population.

Among Mormons, Joseph Smith, the Church's founder, introduced the practice of *plural marriage*. According to the tradition, this practice was revealed directly by God to him in 1843 with reference to the fact that Moses, Abraham, David and

Solomon all had many wives and concubines. Plural marriages became common very soon among his followers. The formal doctrine on "Plurality of Wives" was published in 1876[4] (Mormon Doctrine and Covenants 132: 62):

"And if he have ten virgins given unto him by this law, he cannot commit adultery, for they belong to him, and they are given unto him, therefore is he justified."

The widespread practice of polygyny among the Mormon population caused a strong indignation in US. In response, a later President of the Church gave the order to cease with polygyny in 1890. However, many Fundamentalists members still have polygynous arrangements in parts of the United States (especially in Utah and Arizona)[5].

3.2 The Historical Evolution of Alcohol Use[6]

Historically alcohol has been produced and consumed by the majority of human societies all over the world. Alcoholic beverages existed already in the Neolithic period (cir. 10,000 B.C.) and they were made from berries or honey (Patrick, 1952). In the past, alcohol has always been associated to deities' worship and has played an important role in the majority of ancient religions. It has been consumed as source of nutrition and calories and used for therapeutical and medical

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[4] Concerning the polygynous arrangements, we read:
- Mormon Doctrine and Covenants 132: 3, 4 *"Therefore, prepare thy heart to receive and obey the instructions which I am about to give unto you; for all those who have this law revealed unto them must obey the same." "For behold, I reveal unto you a new and an everlasting covenant; and if ye abide not that covenant, then are ye damned; for no one can reject this covenant, and be permitted to enter into my glory."*

And then concerning those who enter into these polygynous arrangements:
- Mormon Doctrine and Covenants 132: 19, 20 *"and they shall pass by the angels, and the gods, which are set there, to their exaltation and glory in all things. ... Then shall they be gods, because they have all power, and the angels are subject unto them."*

[5] In the US, polygyny became a political and social issue with the introduction of plural marriages by Mormonism. The Model Penal Code (230.1) deals with it: *"A person is guilty of polygamy, a felony of the third degree, if he marries or cohabits with more than one spouse at a time in purported exercise of the right of plural marriage."* Despite illegal and prosecuted by law, it is still practiced among Mormon fundamentalists.

[6] For more elaborate studies on the history of beer and wine, see e.g. Nelson (2005), Meloni and Swinnen (2010), Poelmans and Swinnen (2010).

purposes (Hanson, 1995). In China alcohol had mainly a spiritual function (Fei-Peng, 1982) and it is often mentioned in the manuscripts of Confucius and in the principles of Mencius. In India, the *sona* (wine) was consumed during religious festivals and it was associated with Indra, the warrior God (Sakellari et al., 2003). In ancient Egypt, brewing was well- known and practiced. In the Old Testament we read that *Noah, a man of the soil, proceeded to plant a vineyard* (Genesis 9:20). In ancient Europe, the Greeks and the Romans used to drink wine during their meals and worshipped Dionysius, the God of wine, while Celts and Anglo-Saxons were consuming beer. African societies were traditionally producing alcohol through the fermentation of sorghum, millet, while pre-Columbian societies had a big varieties of alcoholic beverages (for example in Mesoamerica they were drinking *pulche*, a beverage made with the fermented sap of the maguey plant).

In the ancient Western world, an important change in alcohol habits occurred with the expansion of the Roman Empire. They brought wine and viticulture to the *barbarians* that used to drink beer and to despise wine.[7] The Christian Church also played a crucial role in spreading alcohol production[8] (Sournia, 1990). In the Middle Ages, monks and friars became the main depositories of the brewing and winemaking techniques that had been earlier developed (Babor, 1986).

However, also here the industrial revolution seems to have been an important factor. Although there is only imperfect evidence, researchers indicate that the industrial revolution led to the rise in the production and commercialization of distilled alcohol and to a sharp increase of alcohol consumption, especially among the

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[7] As Julius Caesar wrote: "*That there was no access for merchants to them [the Nervii]; that they suffered no wine and other things tending to luxury to be imported; because, they thought that by their use the mind is enervated and the courage impaired"*, De Bello Gallico, Book 2, Chap. 15

[8] Curiously, St. Martin of Tours was said to be preaching the Gospel and planting vineyards at the same time (Patrick, 1952).

lowest classes of the population (Room, 1994; Gigliotti and Bessa, 2004). It is said about distilled alcohol that *"the sixteenth century created it; the seventeenth century consolidated it; the eighteenth popularized it"* (Braudel, 1967, p.170). Moreover, only in the 18th century the effects of drunkenness started to be studied (Sakellari et al., 2003). In the 19th century Rush (1790) and Trotter (1804) published essays on drunkenness and Huss (1849) used the term "alcoholism" for the first time. The strong negative impact of alcoholism led several countries - such as some Northern European countries (Iceland, Norway and Finland), the US, Canada and Australia - to prohibit alcohol during the first decades of the 20th century[9]. However, by the mid 20th century, alcohol prohibition was removed. Since then, alcoholic consumption has been increasing both over time and across countries all over the world.

Yet, there are some exceptions. Alcohol is forbidden in Muslim countries. Alcohol consumption is mentioned in various part of the Quran, but the revelation in Quran, 5.90-91 ("al-Maidah"- The Feast) is particularly important [10]:

"O you who believe! Intoxicants and gambling, (dedication of) stones, and (divination by) arrows, are an abomination,- of Satan's handwork: eschew such (abomination), that you may prosper.
Satan's plan is (but) to excite enmity and hatred between you, with intoxicants and gambling, and hinder you from the remembrance of Allah, and from prayer: will you not then abstain?"

Based on this[11], most Islamic scholars agree that all kinds of drugs and alcohol are forbidden. The major argument is that, by replacing the voice of Allah with false

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[9] Alcohol prohibitionist laws were then repealed in the 1930s. Despite in Scandinavian countries alcohol sales are still controlled and in US there are still some "dry" counties, restrictions on alcohol consumption are disappearing. In an article of the famous newspaper USA Today (July 1, 2010) we read: "Dry America's not-so-sober reality: It's shrinking fast" and then "Once a dry county votes to drop alcohol ban, it doesn't go back".

[10] There are two previous revelations concerning alcohol consumption:
- Quran 4.43 ("An-Nissa" - Women): *O you who believe, do not observe the Contact Prayers [Salat] while intoxicated, so that you know what you are saying,* that forbids intoxication when praying, but not in any other situation.
- Quran, 2.219: ("Baqara"- The Cow): *They ask you concerning wine and gambling. Say: "In them there is great sin, and some profit, for men; but the sin is greater than the profit [Salat] while intoxicated, so that you know what you are saying,* where intoxication is being shunned not just in prayer but in any situation.

information, alcohol alters a person's judgment and makes him act differently from what he would normally do. Any intoxicating has to be avoided in any form (even small amounts of alcohol that are sometimes used in cooking).[12]

In practice, the implementation of this general rule varies across Muslim countries. In countries such as Saudi Arabia and Kuwait - where the *Sharia* is the main source of law - production, importation and consumption of alcohol are completely banned. In Gambia and Malaysia there are alcohol restrictions and it is forbidden to sell alcohol to Muslim people. In India there is no alcohol consumption by the large Muslim minority. Moreover, in India alcohol consumption is prohibited in some states (e.g. Gujarat and Mizoram) and there are nationally "dry" holidays. Despite differences, in general, according to WHO data (2004) per capita consumption in Muslim countries is much lower than in non-Muslim countries.

The same holds for the Mormon religion. Like the practice of polygyny, Muslims and Mormon Fundamentalists share alcohol prohibition[13]. The Mormon rules on alcohol consumption are captured in the Gospel Principle 192 (Chapter 29 - The Lord's Law of Health)[14]:

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[11] Many other insights on Islamic religions come from the *A-Haadith,* "traditions of Muhammad" that clarify concepts not mentioned in the Quran and represent another factor in deciding what is permissible and what is forbidden. From the Islamic book of traditions, *Al-Bukhari*, Aisha, the wife of Muhammad, heard him say, *Of that which intoxicates in a large amount, a small amount is haram* where *haram* means prohibited. And in the book of traditions *As-Sunaan Abu Dawood*, it is written *The prophet prohibited people from the usage of intoxicants and narcotics. Any substance which befogs and intoxicates the mind, the prophet has stopped us from taking it.*

[12] In 4.43, *sukara*, intoxication, is the word used to indicate alcohol and drugs. It derives from the word "sugar" and means drunkenness or intoxication. The verse does not specify the drink that leads to sukara status. In the other verses, the word which is often translated as "wine" or "intoxicants" is *al-khamr*, related to the verb "to ferment". This word could be used to describe other intoxicants such as beer, although wine is the most common understanding of the word. Moreover, since the intoxication itself is harmful and makes one forgetful of God and prayer, over the years, the list of intoxicating substances has come to include also modern street drugs.

[13] Utah has some of the nation's most restrictive alcohol laws (USA Today, July 1, 2010) and it is also the US state where the majority of the Mormon Fundamentalists reside.

[14] The Gospel Principles is the book that sets out some of the basic doctrines and teachings of The Church of Jesus Christ of Latter-day Saints (LDS Church) and that is provided to its members as a personal study guide and as a church lesson manual.

"One of the great blessings we received when we came to earth was a physical body. We need a physical body to become like our Heavenly Father. Our bodies are so important that the Lord calls them temples of God. Our bodies are holy…
The Lord commands us not to use wine and strong drinks, meaning drinks containing alcohol. The First Presidency has taught that strong drink often brings cruelty, poverty, disease, and plague into the home. It often is a cause of dishonesty, loss of chastity, and loss of good judgment. It is a curse to all who drink it."

3.3 Some conclusions

The historical analysis in the previous sections suggests several intriguing observations. First, we find a historical correlation between a global transition from polygynous to monogamous societies and the growth of alcohol consumption. Second, the Greek and Roman empires were the only societies who consumed only wine in their era and at the same time were the only (and first) to introduce formal monogamy. Third, after the Roman Empire collapsed, formal monogamy was maintained and reinforced by the Christian Church – which was also spreading viticulture around Europe and which became the depositary of breweries and winemaking techniques. Fourth, the industrial revolution seems to have played an important role in the transition to effective/actual monogamy and in the growth in alcohol consumption.

In the second part of this paper (section 6) we will provide a series of hypotheses to explain these observations, but first, in section 4, we will analyze whether there is other evidence on the relationship between monogamy and alcohol use.

4. A Cross-Cultural Analysis of Mono/Polygyny and Alcohol Use

4.1 Data and Variables

To further analyze whether there exists a relationship between mono/polygyny and alcohol consumption we searched for data on polygyny and alcohol use across

different societies. After an exhaustive search, we concluded that the best data that is available for such analysis comes from the combination of two unique datasets.

The largest source of data on polygynous practices is Murdock's *Ethnographic Atlas* (1967) that contains ratings on several cultural aspects for 1167 pre-industrial societies from all over the world. However, there are statistical problems with using this large cross-cultural sample. Tests of functional relationships can be confounded because the samples of cultures are not independent – a problem which in cross-cultural research is called "Galton's problem" and which economists call spatial autocorrelation. Murdock and White tried to tackle this problem by extrapolating from the whole sample 186 ethnographically well-described societies, with maximal independence of cases in terms of cultural and historical origin. The 1167 societies in the *Ethnographic Atlas* were divided into about 200 "sampling provinces" of closely related cultures and then one particularly well-documented culture from each sampling province was chosen. This approach resulted in the creation of the Standard Cross-Cultural Sample (SCCS) (Murdock and White, 1969).

We combine these SCCS data with the dataset of Bacon et al. (1965), which provides detailed ratings on different aspects of alcohol consumption for 139 pre-industrial non-European societies. By selecting the cultures included in both datasets, we obtain a final sample of 44 cultures.

The 44 societies are from different parts of the world: 10 societies are located in North America, 11 in South America, 8 in Africa, 9 in Pacific Islands, and 6 in Asia. Figure 1 shows the geographical location of the various societies and Table 1 lists the societies.

The ratings on polygynous practices which we use come from a reviewed and more detailed classification of the SCCS polygynous practices' ratings (White, 1988).

The *Polygyny Index* varies from 1 (= monogamy prescribed) to 5 (= polygyny prevalent and preferred by most men) and indicates the degree of polygyny in a society. In addition, we also use a *Polygyny Dummy* assuming value 0 if the society is monogamous (code 1, 2, 3) and value 1 if the society is polygynous (code 4 and 5). According to this classification, 24 societies are polygynous and 20 monogamous (see Table 1 for descriptive statistics).

Our indicators on alcohol use are from the Bacon et al. (1965) data: *Frequency of Drunkenness* measures how frequently drunkenness occur. *Consumption per Capita* includes also children, adolescents and people who do not drink. *Availability of Alcohol* measures whether alcohol supply was constrained in some societies and without individuals having control over the constraint (for instance, seasonal unavailability of ingredients, etc.).

As regards *Frequency of Drunkenness* and *Consumption per Capita* there are separate ratings for men and women. We use the ratings for men. In *Availability of Alcohol* the sex difference is not indicated. In Bacon et al. (1965), the ratings for each variable are on a 1 - 7 scale. More specifically, in *Frequency of Drunkenness* 1 means "very rare" and 7 means "extreme"; in *Consumption per Capita* 1 means "very small amounts" and 7 means "very large amounts"; in *Availability of Alcohol* 1 means "alcohol available very rarely" and 7 means "alcohol generally available through the year".

Table 1 shows how in 23 societies out of 44, drunkenness occurs more than on average (index higher than 4); in 21 societies out of 44 consumption per capita is above average; for availability of alcohol, alcohol results "generally available through the year" (index equal to 7) in 35 out of 38.

4.2 Statistical Analysis

Table 2 presents simple correlation coefficients among the five variables. To start it is useful to look at the correlations within the groups of indicators. The coefficients indicate, not surprisingly, that *Frequency of Drunkenness* and *Consumption per Capita* are strongly correlated. Interestingly, *Availability of Alcohol* – which is capturing environmental conditions – is correlated with both *Frequency of Drunkenness* and *Consumption per Capita,* but the correlation coefficient is lower between *Availability of Alcohol* and *Frequency of Drunkenness* – which reflects human choices - than between *Availability of Alcohol* and *Consumption per Capita* – which also include economic incentives. Table 2 also shows that the *Polygyny Index* and the *Polygyny Dummy* are also strongly correlated.

Regarding the correlations between polygyny and alcohol indicators, there exist a negative and generally significant correlation between the polygyny variables (*Polygyny Index* and *Polygyny Dummy*) and *Frequency of Drunkenness*. The correlation is particularly strong between *Frequency of Drunkenness* and the *Polygyny Dummy*. Interestingly, *Consumption per Capita* and *Availability of Alcohol* are not significantly correlated with any of the polygyny variables.

We then performed some additional statistical analyses by running the following general regression model:

$$P = \alpha + \beta A + \gamma Z + \varepsilon$$

where P is an indicator of polygyny, A is the vector of alcohol indicators, Z is a vector of regional fixed effects[15], α and β are vectors of coefficients and ε is the error term. Because of the nature of the dependent variable, we use a Probit model when *Polygyny Dummy* is the dependent variable and an Ordered Logit (ologit) model when

[15] For more details on fixed effects regressions see Wooldridge (2002).

Polygyny Index is the dependent variable. Table 3 and 4 present the results from these regressions.

These regressions generally confirm the key conclusions from the correlation analysis. There is a strong negative correlation between polygyny and *Frequency of Drunkenness.* This estimated relationship is robust when controlling for *Availability of Alcohol* due to environmental conditions, which does not affect the statistically estimated effects.

Notice that in Table 3, the coefficient of *Consumption per Capita* becomes significant when controlling for *Availability of Alcohol* and changes when estimated jointly with *Frequency of Drunkenness* (see equation 7) due to the correlation between the explanatory variables.

In conclusion, these results from the cross-cultural analysis are consistent with the historical analysis as they also indicate a positive correlation between monogamy and alcohol consumption (and especially between monogamy and drunkenness) across societies.

The next question is then whether we can find an explanation for this negative correlation. That is the issue we address in the rest of the paper.

5. Explaining the Cross-Cultural Correlation in "Pre-industrial Societies"

5.1 Alcohol use and the structure of the economy

According to the literature on alcohol consumption in pre-industrial societies, there exists a correlation between alcohol consumption and the nature of the economy. Studies find, for example, that hunting tribes drink more than agricultural and settled tribes (Horton, 1945; Field, 1962; Bacon et al., 1965). Several hypotheses why this is the case have been formulated. A first hypothesis is that hunting societies

were less prosperous than agricultural societies. Therefore, hunters have higher subsistence insecurity than settled tribes and drink more to face their anxiety and their problems (Horton, 1945; Bacon et al., 1965). This argument only focuses on the psychological determinants of alcohol consumption and ignores economic incentives. If alcohol is a normal good, one would expect higher consumption in richer countries (Freeman, 2010)[16]. Another hypothesis relates to the structure of the society. Hierarchy and organization, which is typical of agricultural communities, are positively correlated with sobriety (Field, 1962). McClelland et al.(1966) argue that " *sober societies are better organized, hierarchical, solidary, often agricultural and settled communities which give wide and strong support to a man and which stress inhibition and respect. Societies which do not provide a man with this solid support apparently often put him in a conflict situation in which he wants or is expected to assertive and yet must be obedient. He responds by dreaming of solving the conflict by being powerful in a pre-industrial, non-instrumental, impulsive way and finds in alcohol a means of promoting these dreams, of buying, at least temporarily the strength he needs"* (McClelland et al., 1966, pag. 331).

In these arguments, alcohol is a way of facing problems and difficulties and it acts as a sort of "medicine" to find temporary relief[17]. In societies which are hierarchically organized and better structured, such conditions which cause stress (and thus alcohol demand) occur less and social control to limit excessive alcohol use is

[16] Freeman (2010) reviews the literature on this, based on recent data, and concludes that alcohol consumption typically is a normal good in developed economies.

[17] This idea of alcohol as a temporary relief is also present in Freud's philosophy, which argue that the basic instincts of our unconscious are the opposing forces "Libido" and "Thanatos". The first one represents the basic sexual instinct, the second one is an unconscious wish to die. According to Freud, the use of alcohol and drugs, as an attempt to escape reality reflects the death instinct, while polygyny obviously reflects Libido. Interestingly, one could thus argue that our observed negative correlation between polygyny and alcohol is consistent with the opposition between Libido and Thanatos in Freud's philosophy.

stronger. These arguments therefore predict a negative correlation of alcohol consumption with agricultural societies, compared to hunting societies. In contrast, arguments that alcohol is a normal good predict the opposite.

To check whether there is empirical evidence that supports these arguments, we use data from Murdock's *Ethnographic Atlas* on the type of economic structure of the societies included in our analysis. The dataset incorporates information on five major types of economic activity: gathering, hunting, fishing, animal husbandry, and agriculture. For each one of them, an indicator varying between 0 and 9 expresses the relative dependence of the society on that specific economic activity[18]. Among these five activities, agriculture and animal husbandry are typically associated with more social structure and settlements, compared to gathering, hunting and fishing (Horton, 1945; Field, 1962; Bacon et al., 1965; Barber, 2008)[19]. We therefore correlate the alcohol variables with the variables representing the economic activities. The variables *AA* measure the percentage economic dependence of the society on agriculture and animal husbandry. The variable *HFG* is the dependence of the society on hunting, fishing, and gathering.

We would expect that *Frequency of Drunkenness* may better capture the hypothesis of the literature that alcohol is consumed in an instinctive and impulsive way as a relief against difficulties and problems. *Consumption per Capita* may better capture economic incentives as well.

Table 5 presents the correlation coefficients. The coefficients show that the data are consistent with the argument that the nature of the economy affects *Frequency of*

[18] Specifically, 0 means 0 to 5 per cent dependence; 1 means 6 to 15 per cent dependence;….9 means 86 to 100 per cent dependence.

[19] In the literature only agriculture and hunting are used to indicate the type of economy. For the sake of completeness, we group agriculture with animal husbandry and hunting with fishing and gathering. However our results are robust also by simply using agriculture and hunting.

Drunkenness, i.e. in societies that practice agriculture and animal husbandry drunkenness occurs less than in hunting, fishing and gathering societies. Moreover, we do not find a significant correlation with *Consumption per Capita* which suggests that economic incentives (income) may offset the psychological factors in alcohol consumption.

5.2 Mono/Polygyny and the structure of the economy

The literature on polygyny also suggests an important difference in marriage arrangements between hunting and agricultural societies. Hunting tribes are said to have more monogamous marriage arrangements than agricultural tribes. Two explanations are proposed. First, hunting societies were typically less prosperous and faced more economic constraints than agricultural societies. As a result, in hunting tribes, the lack of sufficient and secure resources constrains men in having multiple wives. This is called *ecologically imposed monogamy,* i.e. men do not prefer to be monogamous, but are forced to be monogamous by environmental and economic constraints (Alexander et al., 1979; Flinn et Low, 1986). A second explanation is based on the theory that resource inequality and hierarchy among males are more prevalent in agricultural societies and that these favour polygyny. According to the so-called *resource-defense* theory, polygyny is a *"reproductive strategy that increased with defensible resources"* (Barber, 2008, pag.1). This can be traced back to animal behaviour, when males monopolize a rich breeding territory in order to compete for females and attract them (Emlen and Oring, 1977). The idea is that, since females are better off by sharing the resources of a rich male rather than singularly enjoying the limited resources of a poor male, there is a positive correlation between polygyny and male inequality (Hames, 1996; Kanazawa and Still, 1999). This theory

requires that men can acquire and defend economic resources, e.g. through land ownership or money. Different access to and property rights on crucial resources leads thus to different access to women. Such acquisition and defence of resources is argued to be associated more with agricultural societies than with hunting societies. According to Scheidel (2009, p.3) *"the increasing complexity and socio-economic stratification associated with agrarianism could at times push polygyny to unprecedented levels, especially at the top of the social pyramid"*. The general argument is that a more hierarchical stratification of society is associated with a more unequal distribution of key resources and power that thus leads to more polygyny.

This theory has implications for the relationship between polygyny and the social and economic structure of society. It predicts that there is a positive correlation between agricultural societies and polygyny, and vice versa for hunting societies.

We again use our datasets to empirically test for the relationship between polygynous/monogamous arrangements and the type of economy. Table 6 presents the correlation coefficients, which indicate that the polygyny variables are indeed correlated to the type of economy. As the theory predicts, the polygyny variables are positively correlated with societies' dependence on agriculture and animal husbandry. The coefficient is significant for the *Polygyny Dummy*, but not for the *Polygyny Index*.

In summary, the theoretical arguments presented here to explain cross-cultural differences in alcohol consumption and mono/polygyny are largely consistent with the empirical evidence. In combination they suggest that the empirically observed correlation between alcohol consumption and monogamy across societies are caused by a more fundamental factor which is the nature of the economy. Agricultural societies (compared to hunting societies) are more likely to be polygynous and also to have lower psychological incentives for and more social constraints on drinking

alcohol, resulting in less frequently observed drunkenness. However, these factors may be mitigated to some extent by higher demand for alcohol with higher incomes.

6. Explaining the Historical Correlation

In this final section we provide a set of hypotheses that may help to explain the correlation between alcohol consumption and polygyny/monogamy through history, i.e. the global transition from polygynous to monogamous societies and the growth of alcohol consumption over time.

6.1 The spread of Monogamy and Wine under the Greek and the Roman Empires.

Arguably, a first major step in history towards monogamy is when formal monogamy is introduced in Greece around 1000BC. This rule is maintained by the Romans and is later spread over the Roman Empire. Interestingly, during the centuries of the Greek and Roman Empires, those are the only two regimes which have formal monogamy, and also the only ones that (only) drink wine. The rest of the world is considered *barbarian* by the Greek and the Romans, for both reasons, i.e. for having multiple wives and for drinking beer (Nelson, 2005).

Let us first consider the move to socially imposed monogamy. To understand this, it is important to analyze the distributional effects of polygyny and its implications for the political structures. Grossbard (1980) and Becker (1991) argue that it is not in the first place women who lose out under polygynous societies, but poor men. Rich men benefit by having multiple wives. Women benefit because they have a choice. They can either marry a high status male and share his resources with

other women or singularly enjoy the resources of a low status man. However, poor men are left without women – they are the main losers of this system.

These distributional effects are essential to understand historical changes in this social organization. The distributional effects imply that power structures were required to maintain polygyny. Power was needed to protect against or to repress the social tensions associated with polygyny. Betzig (1986, pag. 100) argues that "*power made polygyny possible, but extreme polygyny required despotic control over society"*. In contrast, monogamy can alleviate social tensions and represent a stabilizing strategy, promoting cohesion and cooperation among men of different social classes. Since poor men, rather than women, are harmed by polygyny, monogamy can be considered a social cohesion strategy (Betzig, 1986).

Interestingly, Scheidel (2009) explains that the emergence of socially imposed formal monogamy in Greece coincides with (a) the growth of "chattel slavery" (where men can have sex with female slaves) and (b) the extension of political rights. Formal monogamy, chattel slavery and male egalitarianism lead in turn to stronger social cohesion and republican institutions (Scheidel, 2009). With the shift to formal monogamy, rich men lost some of their benefits, but only to a limited extent because they could still have polygynous relationships (sex outside their marriage) and because it reduced social pressure from poor men without women (who were the main losers from polygyny). Poor men benefited because their marriage prospects improved with reduced competition from rich men who could only have one wife now. Women lost out: they came to be denied both the potential benefits of polygyny (in the form of access to resource-rich men) as well as the enjoyment of effective monogamy, given that they had no recourse against their husbands' relationships with female slaves.

Interestingly, there is another factor that distinguishes Romans and Greeks from the *barbarians* and it lies in alcohol habits: while in the Greek *poleis* and in the Roman *civitates*, wine was the main alcoholic beverage, the rest of the world was drinking mainly beer or no alcohol. In fact, in many regions in the world which are now associated with wine, people did not drink wine but beer for thousands of years. For example, in what is now France, Spain, Portugal and Northern Italy people drank beer, not wine, in the millennia before the Roman Empire.[20] In contrast, both the Greeks and the Romans drank wine, and only wine, no beer. Moreover, they despised beer and the people who drank it. They referred to them as *barbarians*, uncivilized etc. (Colen and Swinnen, 2010).

The widespread consumption of wine and viniculture did not arrive in large parts of Europe until the Romans conquered these regions. With the Roman conquest of Europe, wine consumption – and later production – spread over the continent. Northern Italy (above the Po-river), then Southern Gaul (France), the Iberian peninsula (Spain and Portugal), and later Northern Gaul (Northern France and Belgium) were conquered one by one, and with it a dramatic geographic spread of wine consumption and production comes. Wine came to supplant beer (or honey beer or mead) as the upper-class beverage in most of these areas. The place where the old beer tradition remained most steadfast was in the region what is now Germany, perhaps due to Germanic influence on Celts (Nelson, 2005).

When the Romans expanded their empire, they exported their customs and rules. Not only wine, but also formal monogamy and democratic institutions entered

[20] There is evidence that the Greeks exported wine to southern France, particularly via Massala (Marseille), starting from around 650 BC and that there was some local production around Massala. However, even after that, for hundreds of years, in Southern Gaul (today's France), wine was a luxury item and only consumed by the upper class. According to Diodorus of Sicily the price of wine was high: Gauls would exchange a slave for one jar of Italian wine (Nelson, 2005, p.49).

for the first time the life of many *barbarians.* They became characteristics of the Western culture in general during the first centuries AD.

With the decline of the Roman empire, the Christian Church played an important role in spreading and preserving both the rule of monogamy and alcohol production, i.e. viticulture as well as beer brewing. Later, while preaching and spreading the word of God, monks, priests and friars maintained and reinforced formal monogamy, but also promoted viticulture and, during the Middle Ages, monasteries became centers of brewery technology and beer production.

6.2 The industrial revolution

The shift to formal monogamy was only one step. As we documented above, even in societies where men could officially only marry one woman, *de facto* polygyny remained very much the case.

Studies suggest that the industrial revolution played a key role in the shift from formal to effective monogamy (Betzig, 1995; Galor et al., Gould et al., 2004) and in the sharp increase of alcohol consumption that became popular among any class of people (Room, 1994; Gigliotti and Bessa, 2004). We suggest here several reasons why this may have been the case. Some of these reasons are related to changes in the social organization, the other to economic changes.

A first hypothesis concerns the social effects of the industrial revolution. Many people moved to urban and industrial areas and left behind the closer social structure and hierarchical organization in their villages. Heavy drinking became an important phenomenon among the new working class, induced by their subordinate

and exploited status and less constrained by the social structure (Sennett and Cobb 1972; Nikelly, 1994).[21]

Second, growing incomes during the industrial revolution may have further stimulated alcohol consumption, as well as the declining price and increased availability of hard-liquor with technological innovations in distillation and brewing technologies.

A third hypothesis is related to our previous discussion on why agricultural tribes had more polygyny than hunting societies, i.e. the capacity of some men to acquire wealth and assets which allowed them to support multiple women. The industrial revolution fundamentally changed the sources of wealth and income. Contrary to traditional societies, where wealth and inequality derive from land ownership, physical capital, etc., the industrial revolution increased the importance of human capital, i.e. income derived from labour income (Gould et al., 2004). In this context, a high consumption of alcohol has negative effects on income by reducing labour productivity (Kenkel and Ribar, 1994; French and Zarkin, 1995). This would imply that the demand for women declined stronger with alcohol consumption after the industrial revolution. Alcohol consumption is likely to affect people's income and wealth less when wealth comes from land asset returns than when people's income derives from labor productivity. This argument would imply that the rate of polygyny decreases with the decrease of the proportion of rich men who are rich because of non-labour income vs. rich men who are rich because of their human capital. This is the change that the industrial revolution caused. Later, this shift in the source of wealth towards human capital was further reinforced by the growth of the service economy and the IT revolution further reinforced this.

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[21] In this context, *"alcohol is a sedative drug, decreasing arousal and anxiety"* Barry, H., 1995. Naroll's analysis of Alcohol problems, pag. 62

A fourth effect of the Industrial Revolution concerns another aspect of the role of human capital as a factor of production. Gould et al. (2004) argue that because in pre-industrial societies human capital is less crucial in determining income and inequality, men are mostly interested in the quantity of children. In this case, all women are substitutes to each other. Women therefore have a low "price" in the marriage market and rich men can afford several wives. However, as the importance of human capital grows with the industrial revolution, men are interested in having "high-quality" children. This raises the demand for "high-quality" women, and their price. It becomes more costly for rich men to have more (high quality) women. Thus, Gould et al. (2004) argue that while male income differences generate polygyny in pre-industrial societies, female quality differences lead to monogamy in industrial societies.

6.3 Summary of Historical Explanations

We find a correlation between alcohol consumption habits and polygynous/monogamous practices through history. The intermediate step of formal monogamy, introduced by the Greeks and Romans and reinforced by the Christian Church, has been accompanied by an important change in alcohol habits: during the expansions of the Roman Empire and the conversion activity of the Church, formal monogamy and wine spread together through Western Europe. Later, the Industrial Revolution brought significant social, economic and technological changes which appear to have played a major role in promoting effective monogamy and simultaneously inducing an increase in mass-alcohol consumption.

7. Conclusion

In this paper, we investigate whether alcohol consumption and polygynous/monogamous arrangements are correlated, both over time and across cultures, and why.

First, we do find a historical correlation between a global shift from polygyny to monogamy and the growth of alcohol consumption. Second, looking at the various societies nowadays, we find that part of the Muslims and the Mormon Fundamentalists are the only two groups (together with some African tribes) that are still practicing polygyny and, interestingly, they also forbid alcohol consumption. Third, using historical data on *pre-industrial societies* – among which there are a substantial number of cases of polygyny – we find a cross-cultural correlation: monogamous societies drink more alcohol than polygynous societies.

We provide several hypotheses to explain these observations. In pre-industrial societies we find that the correlation is related to the nature of the economy. Comparing hunting, gathering and fishing (HFG) societies with societies that practice agriculture and animal husbandry (AA) we find that the former drink more alcohol and are more monogamous. The reason can be higher subsistence insecurity or less hierarchical and structured organization, that characterize HFG societies. On the one hand, there are relatively small differences among men in the control over crucial resources to support multiple women; on the other hand, they may consume a higher quantity of alcohol as a relief and as a way to get rid of their anxiety or to face less social constraints in their society. This relationship is particularly strong for indicators of excessive alcohol use (drunkenness). Lower income in HFG societies may have reduced average demand.

Historically, the global transition from polygynous to monogamous societies and the growth of alcohol consumption finds its basis in some crucial moments of the world history. The Greeks and Romans spread both formal monogamy and viticulture across the ancient world. With the decline of the Roman Empire, the Christian Church maintained and reinforced formal monogamy, albeit that effective polygyny remained widely practiced. At the same time monasteries became centers of brewing and winemaking techniques and spread viticulture around Europe. The industrial revolution brought about the major and definitive change towards effective monogamy and popularization of alcohol consumption. Both changes (in alcohol consumption and in marriage arrangements) were induced by changes in social structures, economic developments and technological innovations associated with the industrial revolution.

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Table 1	*Polygyny Variables*		*Alcohol Variables*			*Type of Economy Variables*				
Societies	***Poly Dummy***	***Poly Index***	***Frequency of Drunkenness***	***Consumption per Capita***	***Availability***	***Agriculture***	***Animal Husbandry***	***Hunting***	***Fishing***	***Gathering***
North America										
Aleut	0	3	6	5.5	7	0	0	3	6	1
Chiricahua	1	4	2.5	3.5	7	0	0	4	0	6
Creek	1	4	2	4	7	4	0	2	2	2
Huichol	0	3	4	4	7	5	1	2	1	1
Kaska	0	3	6	5.5	7	0	0	4	5	1
Omaha	1	4	4	3.5	7	4	0	4	1	1
Papago	1	4	4.5	3.5	7	5	0	2	0	3
Paiute	0	3	5.5	4.5	7	0	0	3	2	5
Saulteaux	0	3	7	5	7	0	0	4	4	2
Zuni	0	1	4	3	7	8	0	1	0	1
South America										
Abipon	1	4	6.5	5.5	n.a.	0	1	6	1	2
Araucanians	1	4	2	3.5	7	6	2	0	1	1
Aymara	0	1	5.5	5	7	6	3	0	1	0
Carib	0	3	7	6	7	4	0	2	2	2
Cayapa	0	1	5	5	7	5	1	1	2	1
Cuna	0	2	6.5	5.5	7	6	0	1	3	0
Goajiro	1	5	6.5	5.5	7	1	7	1	1	0
Jivaro	1	5	5	5	7	6	0	2	1	1
Siriono	0	3	6.5	3	3	1	0	5	1	3
Tehuelche	0	2	6	3	n.a.	0	0	7	1	2
Tupinamba	1	4	6	6	7	4	0	2	2	2

Table 1	*Polygyny Variables*		*Alcohol Variables*			*Type of Economy Variables*				
Societies	*Poly Dummy*	*Poly Index*	*Frequency of Drunkenness*	*Consumption per Capita*	*Availability*	*Agriculture*	*Animal Husbandry*	*Hunting*	*Fishing*	*Gathering*
Africa										
Ashanti	1	5	2	3.5	7	7	0	1	2	0
Azande	1	5	2.5	4	7	6	0	2	1	1
Ganda	1	5	2.5	4.5	7	7	1	1	1	0
Kikuyu	1	5	2	3	7	7	3	0	0	0
Nama	0	3	4.5	3.5	7	0	5	3	1	1
Thonga	1	5	6	6	7	5	3	1	1	0
Tiv	1	5	1.5	2.5	7	5	1	2	1	1
Wolof	1	5	6.5	6	7	6	3	0	1	0
Pacific Islands										
Alorese	1	4	6	5.5	n.a.	7	1	0	0	2
Balinese	1	4	1.5	3	7	6	3	0	1	0
Chukchi	1	4	7	5	n.a.	0	5	2	3	0
Ifugao	0	2	6.5	5.5	7	6	1	2	1	0
Kwoma	1	5	0	0	n.a.	4	1	2	0	3
Lesu	1	4	0.5	0.5	n.a.	4	1	1	4	0
Maori	0	3	3	4	7	4	0	2	2	2
Tikopia	1	4	0	0	0	5	0	0	5	0
Trobrianders	0	3	0	0	0	5	1	0	3	1

Table 1	*Polygyny Variables*		*Alcohol Variables*			*Type of Economy Variables*				
Societies	*Poly Dummy*	*Poly Index*	*Frequency of Drunkenness*	*Consumption per Capita*	*Availability*	*Agriculture*	*Animal Husbandry*	*Hunting*	*Fishing*	*Gathering*
Asia										
Ainu	0	3	6	6	7	1	0	3	4	2
Kazak	1	4	2	4	7	1	8	1	0	0
K. Mongols	0	1	5.5	6	7	1	8	1	0	0
Lakher	0	2	3	4	7	6	1	2	1	0
Lepcha	0	2	2	6.5	7	6	3	1	0	0
Tanala	1	5	2.5	4	7	6	2	0	2	0

Table 2: Correlations

	1	*2*	*3*	*4*	*5*
1. Frequency of Drunkenness	*--*				
2. Consumption per Capita	*0.759****	*--*			
3. Availability of Alcohol	*0.368***	*0.695****	*--*		
4. Polygyny Dummy	*-0.361***	*-0.215*	*0.063*	*--*	
5. Polygyny Index	*-0.304***	*-0.201*	*0.013*	*0.851****	*--*

*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*

Table 3

Regression results (Probit Model). Dependent Variable: Polygyny Dummy

	1	*2*	*3*	*4*	*5*	*6*	*7*
Freq. of Drunkenness	*-0.223***	*--*	*--*	*-0.361****	*-0.280**	*--*	*-0.326**
	(0.099)			*(0.120)*	*(0.163)*		*(0.186)*
Consump. per Capita	*--*	*-0.173*	*--*	*--*	*0.102*	*-0.470***	*-0.088*
		(0.128)			*(0.226)*	*(0.212)*	*(0.337)*
Availab. of Alcohol	*--*	*--*	*0.048*	*0.233**	*--*	*0.341**	*0.271*
			(0.128)	*(0.140)*		*(0.179)*	*(0.192)*
Observations:	*44*	*44*	*38*	*38*	*44*	*38*	*38*
Pseudo R-squared:	*0.0989*	*0.0348*	*0.00289*	*0.178*	*0.104*	*0.107*	*0.180*

*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*
Robust standard errors in parentheses

Regression results (Probit Model). Dependent Variable: Polygyny Dummy

	1	*2*	*3*	*4*	*5*	*6*	*7*
Freq. of Drunkenness	*-0.246***	*--*	*--*	*-0.625****	*-0.432***	*--*	*-0.671****
	(0.116)			*(0.157)*	*(0.182)*		*(0.227)*
Consump. per Capita	*--*	*-0.132*	*--*	*--*	*0.305*	*-0.574***	*0.102*
		(0.143)			*(0.248)*	*(0.248)*	*(0.426)*
Availab. of Alcohol	*--*	*--*	*0.013*	*0.220*	*--*	*0.343**	*0.180*
			(0.150)	*(0.150)*		*(0.203)*	*(0.234)*
Regional Fixed Effects[22]	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations:	*44*	*44*	*38*	*38*	*44*	*38*	*38*
Pseudo R-squared:	*0.195*	*0.128*	*0.123*	*0.353*	*0.222*	*0.220*	*0.354*

*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*
Robust standard errors in parentheses

[22] Whenever the regional fixed effect is used, the regions considered are: North America, South America, Africa, Pacific Islands, Asia.

Table 4

Regression results. Dependent Variable: Polygyny Index

	1	2	3	4	5	6	7
Freq. of Drunkenness	*-0.258***	*--*	*--*	*-0.326***	*-0.348*	*--*	*-0.243*
	(0.116)			*(0.150)*	*(0.236)*		*(0.256)*
Consump. per Capita	*--*	*-0.203*	*--*	*--*	*0.154*	*-0.537*	*-0.215*
		(0.153)			*(0.332)*	*(0.329)*	*(0.591)*
Availab. of Alcohol	*--*	*--*	*0.035*	*0.183**	*--*	*0.362**	*0.275*
			(0.078)	*(0.107)*		*(0.205)*	*(0.268)*
Observations:	*44*	*44*	*38*	*38*	*44*	*38*	*38*
Pseudo R-squared:	*0.0326*	*0.0118*	*0.0005*	*0.0392*	*0.0351*	*0.0303*	*0.0412*

*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*
Robust standard errors in parentheses

Regression results Dependent Variable: Polygyny Index

	1	2	3	4	5	6	7
Freq. of Drunkenness	*-0.255***	*--*	*--*	*-0.389****	*-0.374**	*--*	*-0.427*
	(0.122)			*(0.125)*	*(0.212)*		*(0.326)*
Consump. per Capita	*--*	*-0.176*	*--*	*--*	*0.205*	*-0.512*	*0.094*
		(0.182)			*(0.317)*	*(0.376)*	*(0.757)*
Availab. of Alcohol	*--*	*--*	*-0.059*	*0.081*	*----*	*0.237*	*0.040*
			(0.125)	*(0.109)*		*(0.239)*	*(0.350)*
Regional Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Observations:	*44*	*44*	*38*	*38*	*44*	*38*	*38*
Pseudo R-squared:	*0.160*	*0.144*	*0.148*	*0.186*	*0.164*	*0.166*	*0.187*

*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*
Robust standard errors in parentheses

Table 5

Regression results.

Dep.Var:	***Frequency of Drunkenness***		***Consumption per Capita***	
	Ologit	*Ologit*	*Ologit*	*Ologit*
AA	*-0.191***	*--*	*0.009*	*--*
	(0.076)		*(0.086)*	
HFG	*--*	*0.191***	*--*	*-0.009*
		(0.076)		*(0.086)*
Observations:	*44*	*44*	*44*	*44*
Pseudo R-squared:	*0.0226*	*0.0226*	*4.99e-05*	*4.99e-05*
*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*				
Robust standard errors in parentheses				

Regression results.

Dep.Var:	***Frequency of Drunkenness***		***Consumption per Capita***	
	Ologit	*Ologit*	*Ologit*	*Ologit*
AA	*-0.173***	*--*	*-0.026*	*--*
	(0.082)		*(0.122)*	
HFG	*--*	*0.173***	*--*	*0.026*
		(0.082)		*(0.122)*
Regional Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*
Observations:	*44*	*44*	*44*	*44*
Pseudo R-squared:	*0.069*	*0.069*	*0.048*	*0.048*
*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*				
Robust standard errors in parentheses				

Table 6:

Regression results.

Dep.Var:	***Polygyny Dummy***		***Polygyny Index***	
	Probit	*Probit*	*Ologit*	*Ologit*
AA	*0.127**	*--*	*0.128*	*--*
	(0.065)		*(0.095)*	
HFG	*--*	*-0.127**	*--*	*-0.128*
		(0.065)		*(0.095)*
Observations:	*44*	*44*	*44*	*44*
Pseudo R-squared:	*0.0633*	*0.0633*	*0.015*	*0.015*
*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*				
Robust standard errors in parentheses				

Regression results.

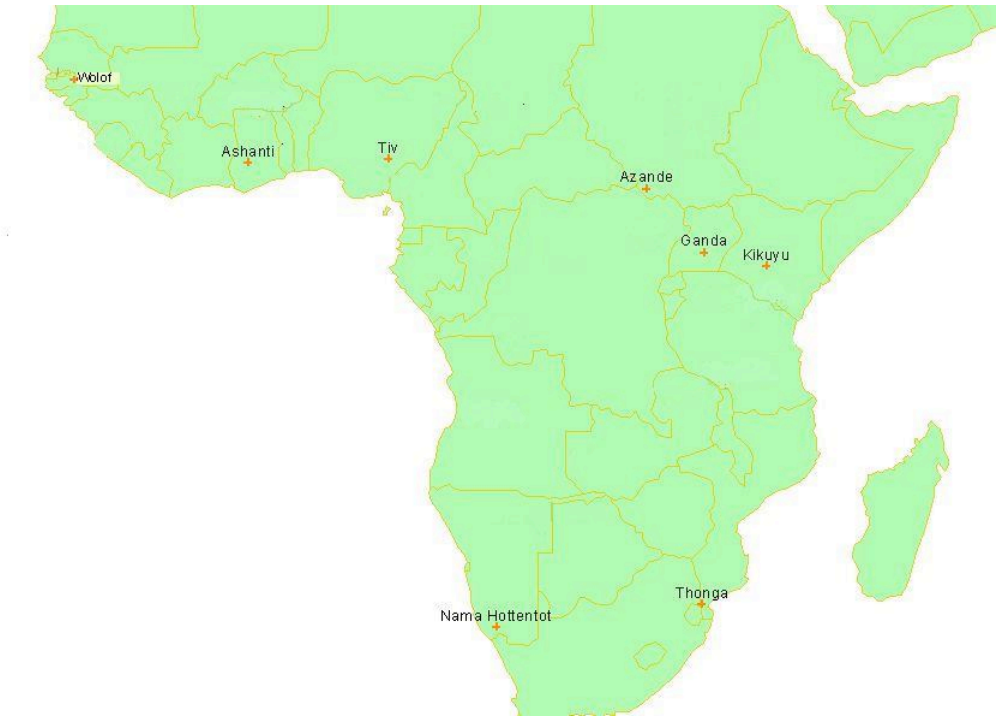
Dep.Var:	***Polygyny Dummy***		***Polygyny Index***	
	Probit	*Probit*	*Ologit*	*Ologit*
AA	*0.123*	*--*	*0.006*	*--*
	(0.083)		*(0.134)*	
HFG	*--*	*-0.123*	*--*	*-0.006*
		(0.083)		*(0.134)*
Regional Fixed Effects	*Yes*	*Yes*	*Yes*	*Yes*
Observations:	*44*	*44*	*44*	*44*
Pseudo R-squared:	*0.069*	*0.069*	*0.048*	*0.048*
*Significance level: *significant at 10%, **significant at 5%, ***significant at 1%*				
Robust standard errors in parentheses				

Figure 1: Location of the societies

North America: *Aleut, Chiricahua, Creek, Huichol, Kaska, Omaha, Paiute, Papago, Saulteaux, Zuni.*

South America: *Abipon, Araucanians, Aymara, Carib, Cayapa, Cuna, Goajiro, Jivaro, Siriono, Tehuelche, Tupinamba.*

Africa: *Ashanti, Azande, Ganda, Kikuyu, Nama, Tiv, Thonga, Wolof.*



Pacific Islands: *Alorese, Balinese, Chukchee, Ifugao, Kwoma, Lesu (New Ireland), Maori, Tikopia, Trobrianders.*

Asia: *Ainu, Kazak, K.Mongols, Lakher, Lepcha, Tanala.*